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ABSTRACT

The United States Training and Employment Service General Aptitude Test Battery (GATB), first published in 1947, has been included in a continuing program of research to validate the tests against success in many different occupations. The GATB consists of 12 tests which measure nine aptitudes: General Learning Ability; Verbal Aptitude; Numerical Aptitude; Spatial Aptitude; Form Perception; Clerical Perception; Motor Coordination; Finger Dexterity; and Manual Dexterity. The aptitude scores are standard scores with 100 as the average for the general working population, and a standard deviation of 20. Occupational norms are established in terms of minimum qualifying scores for each of the significant aptitude measures which, when combined, predict job performance. Cutting scores are set only for those aptitudes which aid in predicting the performance of the job duties of the experimental sample. The GATB norms described are appropriate only for jobs with content similar to that shown in the job description presented in this report. A description of the validation sample is also included. (AG)

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ED 063403

TM 001 230

Development of USES Aptitude Test Battery

for

Compression-Molding-Machine Tender

(fabric. plastics prod.) 556.885

U.S. DEPARTMENT OF LABOR
MANPOWER ADMINISTRATION

Technical Report on Development of USES Aptitude Test Battery

For . . . .

Compression-Molding-Machine Tender (fabric. plastics prod.) 556.885

S-218

(Developed in Cooperation with the
Wisconsin State Employment Service)

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October 1968

FOREWORD

The United States Employment Service General Aptitude Test Battery (GATB) was first published in 1947. Since that time the GATB has been included in a continuing program of research to validate the tests against success in many different occupations. Because of its extensive research base the GATB has come to be recognized as the best validated multiple aptitude test battery in existence for use in vocational guidance.

The GATB consists of 12 tests which measure 9 aptitudes: General Learning Ability, Verbal Aptitude, Numerical Aptitude, Spatial Aptitude, Form Perception, Clerical Perception, Motor Coordination, Finger Dexterity, and Manual Dexterity. The aptitude scores are standard scores with 100 as the average for the general working population, with a standard deviation of 20.

Occupational norms are established in terms of minimum qualifying scores for each of the significant aptitude measures which, in combination, predict job performance. For any given occupation, cutting scores are set only for those aptitudes which contribute to the prediction of performance of the job duties of the experimental sample. It is important to recognize that another job might have the same job title but the job content might not be similar. The GATB norms described in this report are appropriate for use only for jobs with content similar to that shown in the job description included in this report.

Charles E. Odell, Director
U.S. Employment Service

GATB Study #2362, 2225

DEVELOPMENT OF USES APTITUDE TEST BATTERY

FOR

Compression-Molding-Machine Tender(fabric. plastics prod.) 556.885-034

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This report describes research undertaken for the purpose of developing General Aptitude Test Battery (GATB) norms for the occupation of Compression-Molding-Machine Tender (fabric. plastics prod.) 556.885-034. The following norms were established.

GATB Aptitudes	Minimum Acceptable GATB Scores
K-Motor Coordination	75
F-Finger Dexterity	85
M-Manual Dexterity	85

RESEARCH SUMMARY-VALIDATION SAMPLE

Sample

The validation sample was comprised of two subsamples. The workers in each subsample were employed as Compression-Molding Machine Tenders at the Plastics Engineering Company, Sheboygan, Wisconsin. There were 56 workers in the final sample.

Criterion

Broad category ratings

Design:

Concurrent (test and criterion data were collected at approximately the same time)

Minimum aptitude requirements were determined on the basis of a job analysis and statistical analyses of aptitude mean scores, standard deviations, aptitude criterion correlations and selective efficiencies.

Concurrent Validity:

Phi Coefficient=.62 ($p/2 < .0005$)

Effectiveness of Norms:

Only 70% of the non-test-selected workers used for this study were good workers; if the workers had been test-selected with the above norms, 90% would have been good workers. 30% of the non-test-selected workers used for this study were poor workers; if the workers had been test-selected with the above norms, only 10% would have been poor workers. The effectiveness of the norms is shown graphically in Table 1.

TABLE 1

Effectiveness of Norms

	Without Tests	With Tests
Good Workers	70%	90%
Poor Workers	30%	10%

SAMPLE DESCRIPTION-VALIDATION SAMPLE

Size:
N=56

Occupational Status:
Employed workers

Work Setting:
Workers were employed at the Plastics Engineering Company, Sheboygan, Wisconsin.

Selection Requirements:
Education: No requirement

Previous Experience: No requirement

Tests: None

Other: Personal interview and a check of references.

Principal Activities: The job duties for each worker are comparable to those shown in the job description in the Appendix.

Minimum Experience: All workers had at least one month job experience since one month is usually required for a worker to reach average production.

TABLE 2

Means, Standard Deviation (SD), Ranges, and Pearson Product-Moment Correlations (Corrected for Board Categories) with the Criterion(c^r) for Age, Education, and Experience

	Mean	SD	Range	r
Age (years)	32.6	9.8	18-35	-.338*
Education (years)	10.6	1.9	6-14	.283*
Experience (months)	47.0	44.2	1-186	.143

* Significant at the .05 level

EXPERIMENTAL TEST BATTERY

All the tests of the GATB, B-1001, with the exception of Part E, were administered to the original sample group in December 1951. The 12 tests of the GATB, B-1002A, were administered to the second sample group of 35 workers in June 1961. The B-1001 scores were converted to equivalent B-1002 A scores.

CRITERION

The criterion consisted of grouped rank order ratings by the production superintendent and the three shift foremen. The workers on each shift were ranked separately and grouped into three groups--above average, average, and below average. The 35 workers in the second sample group were rated twice with a three week interval between ratings. A Pearson product-moment correlation of .95 was obtained between these two ratings. The final criterion consisted of combined broad category ratings. Combining the workers resulted in five broad category group: group A - 17 workers, group B - 4 workers, group C - 18 workers, group D - 2 workers, and group E - 15 workers. The qualitative values were converted to numerical scores which resulted in criterion scores of 62 for group A, 54 for group B, 49 for group C, 44 for group D, and 38 for group E.

Criterion Dichotomy: The criterion distribution was dichotomized into high and low groups by placing 30% the sample into the low group to correspond with the percentage of workers considered unsatisfactory or marginal. Workers in broad category groups A, B, and C were designated as "good workers" and those in broad category groups D and E were designated as "poor workers".

APTITUDES CONSIDERED FOR INCLUSION IN THE NORMS

Aptitudes were considered for tryout in the norms on the basis of a qualitative analysis of the job and course duties involved and a statistical analysis of test and criterion data. Aptitudes V and N which have a significant correlation with the criterion were not considered for inclusion in the norms since these two aptitudes were rated irrelevanton the basis of job analysis data to the successful performance of the duties of the job. Tables 3, 4, and 5 show the results of the qualitative and statistical analyses.

TABLE 3

Qualitative Analysis

(Based on the job analysis, the aptitudes indicated appear to be important to the work performed.)

Aptitude	Rationale
P-Form Perception	Required in determining the correct insert to be positioned in the mold cavities, detecting sprue and flashing on molded products, and in visually inspecting molded products for defects.
K-Motor Coordination F- Finger Dexterity	Required in rapidly and accurately placing inserts into mold cavities.
M-Manual Dexterity	Required in manipulating levers, pressing buttons and turning valves on press, on placing plastic biscuits in mold cavities, and in removing molded product from mold.

TABLE 4

Means, Standard Deviations (SD), Ranges, and Pearson Product-Moment Correlations (Corrected for Broad Categories) with the Criterion (c^r) for the Aptitudes of the GATB

Aptitude	Mean	SD	Range	r
G-General Learning Ability	102.8	17.2	[illegible]-134	.399**
V-Verbal Aptitude	98.0	15.8	66-133	.381**
N-Numerical Aptitude	100.9	17.6	61-133	.438**
S-Spatial Aptitude	106.5	22.5	58-169	.216
P-Form Perception	102.2	18.7	57-135	.533**
Q-Clerical Perception	101.2	17.3	63-144	.384**
K-Motor Coordination	95.6	18.0	45-132	.528**
F-Finger Dexterity	99.5	19.7	53-143	.314*
M-Manual Dexterity	109.9	20.8	62-149	.362**

*Significant at .05 level
**Significant at .01 level

TABLE 5

Summary of Qualitative and Quantitative Data

Type of Evidence	Aptitudes								
	G	V	N	S	P	Q	K	F	M
Job Analysis Data: Important					X		X	X	X
Irrelevant		X	X						
Relatively High Mean	X			X	X				X
Relatively Low Standard Dev.									
Significant Correlation with Criterion	X	X	X		X	X	X	X	X
Aptitudes to be Considered for Trial Norms	G				P	Q	K	F	M

DERIVATION AND VALIDITY OF NORMS

Final norms were derived on the basis of a comparison of the degree to which trial norms consisting of various combinations of Aptitudes G, P, Q, K, F, and M at trial cutting scores were able to differentiate between the 70% of the sample considered good workers and the 30% of the sample considered poor workers. Trial cutting scores at five point intervals approximately one standard deviation below the mean are tried because this will eliminate about one third of the sample with three-aptitude norms. For two-aptitude trial norms, minimum cutting scores of slightly more than one standard deviation below the mean will eliminate about one third of the sample; for four-aptitude trial norms, cutting scores slightly less than one standard deviation below the mean will eliminate about one-third of the sample. The Phi Coefficient was used as a basis for comparing trial norms. Norms of K-75, F-85, and M-85 provided the optimum differentiation for the occupation of Compression-Molding-Machine Tender (fabric. plastics prod.) 556.885-034. The validity of these norms is shown in Table 6 and is indicated by a Phi Coefficient of .62 (statistically significant at the .0005 level).

TABLE 6

Concurrent Validity of Test Norms

K-75, F-85, and M-85

	Nonqualifying Test Scores	Qualifying Test Scores	Total
Good Workers	4	35	39
Poor Workers	13	4	17
Total	17	39	56

Phi Coefficient (Ø)= .62 Chi Square (X^2_y) = 21.5
Significance Level = P/2 < .0005

DETERMINATION OF OCCUPATIONAL APTITUDE NORMS

The data for this study met the requirements for incorporating the occupation studied into OAP-35 which is shown in Section II of the Manual for the General Aptitude Test Battery. A Phi Coefficient of .44 is obtained with the OAP-35 norms of K-85, F-80 and M-80.

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GATB #2225

Compression-Molding-Machine Tender (fabric. plastics prod.) 556.885-034

Check Study Research Summary

Sample:

35 (23 male and 12 female) workers employed as Compression-Molding-Machine Tenders at the Flambeau Plastics Corporation, Baraboo, Wisconsin.

TABLE 7

Means, Standard Deviations (SD), Ranges and Pearson Product-Moment Correlations with Criterion (r) for Age, Education and Experience and the Aptitudes of the GATB-Cross Validation Sample

	Mean	SD	Range	r
Age (years)	29.9	6.0	19-40	.071
Education (years)	10.0	1.8	6-12	-.053
Experience (months)	22.2	18.4	2-84	-.264
G-General Learning Ability	99.9	13.2	73-140	.053
V-Verbal Aptitude	96.5	15.3	74-137	.114
N-Numerical Aptitude	98.8	16.8	69-141	.174
S-Spatial Aptitude	99.2	14.8	71-124	-.233
P-Form Perception	99.0	12.6	74-127	.430**
Q-Clerical Perception	100.7	12.0	77-125	.384*
K-Motor Coordination	102.5	14.0	62-128	.580**
F-Finger Dexterity	94.6	19.1	53-138	.356*
M-Manual Dexterity	112.8	19.6	84-149	.472**

* Significant at the .05 level

** Significant at the .01 level

Criterion:

Combined rank order ratings

Design:

Concurrent (test and criterion data were collected at approximately the same time).

Principal Activities:

The duties for this sample are comparable to those shown in the job description in the Appendix.

Concurrent Validity:

Phi Coefficient (ϕ) = .33 ($P/2 < .05$

Effectiveness of Norms:

Only 66% of the nontest-selected workers used for this study were good workers; if the workers had been test-selected with the S-218 norms, 77% would have been good workers. 34% of the nontest-selected workers used for this study were poor workers; if the workers had been test selected with S-218 norms only 23% would have been poor workers. The effectiveness of the norms is shown graphically on Table 8.

TABLE 8

Effectiveness of S-218 Norms
on Check Study Sample

	Without Tests	With Tests
Good Workers	66%	77%
Poor Workers	34%	23%

TABLE 9

Concurrent Validity of S-218 Norms
(K-95, F-85, M-85) on Check Study
Sample

	Nonqualifying Test Scores	Qualifying Test Scores	Total
Good Workers	3	20	23
Poor Workers	6	6	12
Total	9	26	35

Phi Coefficient (Ø) = .33
Chi Square (X^2_y) = 3.8
Significance Level = P/2 < .05

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FACT SHEET

Job Title

Compression-Molding-Machine Tender (fabric. plastics prod.) 556.885-034

Job Summary

Operates 120 to 600 ton hydraulic compression and transfer molding machines to mold a variety of plastic products, such as toilet seats, distributor caps for outboard motors, and handles for kitchen utensils and various appliances.

Work Performed

Waxes molds at start of operation to avoid sticking and to assure fine finish on plastic products. Places preformed plastic biscuits or pellets into electronic grading or steam ovens for a specific period of time to preheat for molding operation. Feels biscuits to determine if preformed plastic biscuit or pellets are of the proper consistency. Adjusts electronic grading oven to proper temperature by turning gauge to higher or lower temperature to insure proper consistency. Hand feeds biscuits or pellets directly onto press mold, drops them into cavities of mold or places them into cavities of special removable mold assembly and places assembly into press. May feed biscuits or pellets to molds by means of loading fixtures on press. May weigh preformed plastic biscuits before heating in electronic grading oven to determine that there is the correct amount of plastic for the operation. May position a variety of inserts in mold cavities such as metal rivets, electrical conduction pins, core pins for intricate designs and threading pins to form threads in plastic. May tap inserts into cavities with brass hammer. Manipulates levers, presses buttons and turns valves on press to gradually apply high or low hydraulic pressure to compress materials under high temperature and pressure. Removes molded product from mold by hand or removes mold assembly from press and disassembles to remove product. May remove products by means of unloading jigs. Blows out mold dies with air nozzle between molding cycles to assure clean dies. May break, cut, file, grind or trim sprue and flashing (excess plastic at seams or contact points) from molded products on workbench by hand or by use of gauges, files, abrasive screens, grinders, broachers and other bench machines. May remove core pins and thread inserts using special fixtures.

Visually inspects molded products coming from press for major defects and notifies foreman of malfunctioning of press. Occasionally may alternate between two presses on certain types of jobs.

Effectiveness of Norms

Only 70% of the nontest-selected workers used for this study were good workers; if the workers had been test-selected with the S-218 norms, 90% would have been good workers. Thirty percent of the nontest-selected workers used for this study were poor workers; if the workers had been test-selected with the S-218 norms,only 10% would have been poor workers. (Validation sample)

Only 66% of the nontest-selected workers used for this study were good workers; if the workers had been test-selected with the S-218 norms, 77% would have been good workers. Thirty-four percent of the nontest-selected workers used for this study were poor workers; if the workers had been test-selected with the S-218 norms, only 23% would have been poor workers. (Cross-Validation sample)

Applicability of S-218 Norms

The aptitude test battery is applicable to jobs which include a majority of job duties described above.

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